Eutrophication of Tenkiller Reservoir, Oklahoma and Effects on Water Quality and Fisheries

Expert Report of Dr. G.D. Cooke and Dr. E.B. Welch

for

State of Oklahoma

in

Case No. 05-CU-329-GKF-SAJ

State of Oklahoma v. Tyson Foods, et al.

(In the United States District Court for the Northern District of Oklahoma)

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EXHIBIT
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I. OPINIONS

These are the goals of this study: 1) determine the past and current trophic state (degree of eutrophication) of Tenkiller Reservoir, Oklahoma, 2) assess consequences of the reservoir's trophic state to reservoir users and reservoir biota, 3) determine the causal factors in changes of reservoir trophic state, and 4) compare the trophic state of Tenkiller to Broken Bow Reservoir, which is little impacted by nutrient-rich runoff.

The opinions and conclusions listed below are supported by evidence in the text, tables, and figures in the accompanying report by G. Dennis Cooke and Eugene B. Welch.

Past reservoir trophic state was assessed by critical reviews of agency reports and published literature. Additionally, probable past and future reservoir conditions were evaluated based on the models provided by Engel (2008) and Wells (2008). Current trophic state (2005-2007) was assessed by sampling Tenkiller and Broken Bow by CDM, using appropriate and standard field and laboratory methods to determine total phosphorus (TP), total nitrogen (TN), chlorophyll (chl), algal species and biovolumes, dissolved oxygen (DO), water transparency, trihalomethanes, organic carbon, and benthic macroinvertebrate density.

Reservoir trophic state is described by amounts of algae (as chl and biovolume) in the upper (0-6 meter depth) water column during summer months, and by associated variables that cause algae growth or are a consequence of it. These latter variables include nutrients (TP, TN), water clarity, and DO.

Trophic state varies over the summer in the same reservoir, and between reservoir areas near the river inflows and areas near the dam. Variations are caused by differences in nutrient concentrations.

A. Opinions and Conclusions of Dr. G. Dennis Cooke

- Tenkiller was borderline oligotrophic-mesotrophic in 1974-1975. Amounts and types of algae in 1961, 1974 and 1975 were those of oligotrophic reservoirs.

- Tenkiller switched to eutrophic by 1986 and remained so through 2007, except in 2006 when drought conditions reduced the impact of TP-rich river inflows. The amounts and types of algae were those of eutrophic reservoirs. The upper reservoir area, receiving TP-rich river inflows, was hypereutrophic in 1986 through 2007. Lower reservoir areas were mesotrophic during droughts due to sedimentation of inflowing nutrients in the upper reservoir and eutrophic during non-drought summers.

- The quantity of algae in Tenkiller and Broken Bow, and hence their trophic states, varied with the concentrations of TP in the reservoir water. Phosphorus is the nutrient controlling algae growth in these reservoirs.